

REMARKS

Claims 1-55 are resubmitted without amendment for reconsideration in the light of the following authorities and remarks and those previously presented.

The requirement for restriction is again respectfully traversed based on the authorities and remarks previously presented in the response transmitted November 19, 2004. The office action did not dispute that examination of all claims can be made without undue burden.

Accordingly, Examination of claims 3, 10, 20, 27-30, 37-43 and 45 on the merits is respectfully requested.

1. The drawings are objected to because of minor informalities in the reference numbers in FIGS. 4E and 4F. We are submitting a letter to the official draftsman with a request to substitute a replacement sheet overcoming these formal objections.

2. The disclosure is objected to because armature assembly 64 should be --armature assembly 66. Deferral of this correction is respectfully requested pending the allowance of claims.

3. Claim 13 is objected to because "parallel l" in claim 14 should be -- parallel --. Deferral of this correction is respectfully requested pending allowance of claims.

4,5. Claims 1, 2, 4-9, 11-19, 21, 32 and 35 stand rejected under 35 U.S.C §102(b) as being anticipated by Hoppie. The office action states:

Hoppie discloses an electromagnetic actuator (See Figs 1-5, and 7), comprising: a stator assembly (50) having an inner surface that defines an opening, the stator assembly comprising: a coiled conductor (52) disposed near the inner surface of the stator assembly, wherein the coiled conductor is adapted to generate a first magnetic field when current is applied; a center pole formed of a material (60) having high magnetic permeability and having a longitudinal axis; and an armature assembly (56) at least partially disposed within the stator assembly opening, the armature assembly comprising: a permanent magnet (58; 190), wherein the armature assembly moves in a direction parallel to the longitudinal axis of the center pole when current is applied to the coiled conductor assembly; wherein the magnet is radially magnetized; wherein adjacent coils are configured to generate magnetic fields having opposite polarity; wherein the plurality of coils are connected in series; wherein adjacent coils are wound in opposite directions; wherein the stator assembly further comprises one or more

back iron members formed of a material having high magnetic permeability; wherein the permanent magnet is ring-shaped and defines longitudinal axis that is parallel with the longitudinal axis of the center pole; wherein the longitudinal axis of the permanent magnet is coaxial with the longitudinal axis of the center pole; wherein the stator assembly defines a longitudinal axis that is parallel to the longitudinal axis of the center pole; where in the longitudinal axis of the stator assembly is coaxial with the longitudinal axis of the center pole; wherein the permanent magnet is radially magnetized (See Fig. 5); wherein the magnet has one or more discontinuities such that the dominant eddy current path is interrupted; wherein the permanent magnet comprises a plurality of arc-shaped segments; wherein the armature assembly further comprises a valve stem (64) adapted to open or close a valve when current is applied to the coiled conductor; wherein the armature assembly further comprises: a means (See Figs. 1, 5, and 7) for coupling the valve stem to the remainder of the armature assembly; wherein the center pole is formed of a paramagnetic material; wherein the center pole is at least partially formed of ferromagnetic material. Pp. 5-6.

This ground of rejection is respectfully traversed. "It is well settled that anticipation under 35 U.S.C. 102 requires the presence in a single reference of all of the elements of a claimed invention." *Ex parte Chopra*, 229 U.S.P.Q. 230, 231 (BPA&I 1985) and cases cited.

"Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim." *Connell v. Sears, Roebuck & Co.*, 220 U.S.P.Q. 193, 198 (Fed. Cir. 1983).

"This court has repeatedly stated that the defense of lack of novelty (i.e., 'anticipation') can only be established by a single prior art reference which discloses each and every element of the claimed invention." *Structural Rubber Prod. Co. v. Park Rubber Co.*, 223 U.S.P.Q. 1264, 1270 (Fed. Cir. 1984), citing five prior Federal Circuit decisions since 1983 including *Connell*.

In a later analogous case the Court of Appeals for the Federal Circuit again applied this rule in reversing a denial of a motion for judgment n.o.v. after a jury finding that claims were anticipated. *Jamesbury Corp. v. Litton Industrial Prod., Inc.*, 225 U.S.P.Q. 253 (Fed. Cir. 1985).

After quoting from *Connell*, "Anticipation requires the presence in a single prior art disclosure of all elements of a claimed invention arranged as in the claim," 225 U.S.P.Q. at 256, the court observed that the patentee accomplished a constant tight contact in a ball valve by a lip on the seal or ring which interferes with the placement of the ball. The lip protruded into the

area where the ball will be placed and was thus deflected after the ball was assembled into the valve. Because of this constant pressure, the patented valve was described as providing a particularly good seal when regulating a low pressure stream. The court quoted with approval from a 1967 Court of Claims decision adopting the opinion of then Commissioner and later Judge Donald E. Lane:

[T]he term "engaging the ball" recited in claims 7 and 8 means that the lip contacts the ball with sufficient force to provide a fluid tight seal. *** The Saunders flange or lip only sealingly engages the ball 1 on the upstream side when the fluid pressure forces the lip against the ball and never sealingly engages the ball on the downstream side because there is no fluid pressure there to force the lip against the ball. The Saunders sealing ring provides a compression type of seal which depends upon the ball pressing into the material of the ring. *** The seal of Saunders depends primarily on the contact between the ball and the body of the sealing ring, and the flange or lip sealingly contacts the ball on the upstream side when the fluid pressure increases. 225 U.S.P.Q. at 258.

Relying on *Jamesbury*, the ITC said, "Anticipation requires looking at a reference, and comparing the disclosure of the reference with the claims of the patent in suit. A claimed device is anticipated if a single prior art reference discloses all the elements of the claimed invention as arranged in the claim." *In re Certain Floppy Disk Drives and Components Thereof*, 227 U.S.P.Q. 982, 985 (U.S. ITC 1985).

Claim 1 and the claims dependent thereon recite "a center pole formed of material having high magnetic permeability," a feature absent from the reference. Accordingly, withdrawal of the rejection of claims 1, 2, 4-9, 11-19, 21, 32 and 35 as anticipated by the reference is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim the language in the reference regarded as corresponding to "a center pole formed of a material having high magnetic permeability."

6. Claims 1, 2, 4-9, 11-19, 21, 25, 26, 31, 32 and 35 stand rejected under 35 U.S.C. §102(e) as anticipated by Grundl.

The office action states:

Grundl discloses an electromagnetic actuator (See Figs 1-6), comprising: a stator assembly (40) having an inner surface that defines an opening, the stator

assembly comprising: a coiled conductor (18', 28) disposed near the inner surface of the stator assembly, wherein the coiled conductor is adapted to generate a first magnetic field when current is applied; a center pole (18'') formed of a material having high magnetic permeability and having a longitudinal axis; and an armature assembly (16) at least partially disposed within the stator assembly opening, the armature assembly comprising: a permanent magnet (30), wherein the armature assembly moves in a direction parallel to the longitudinal axis of the center pole when current is applied to the coiled conductor assembly; wherein the magnet is radially magnetized; wherein adjacent coils are configured to generate magnetic fields having opposite polarity; wherein the plurality of coils are connected in series; wherein adjacent coils are wound in opposite directions; wherein the stator assembly further comprises one or more back iron members formed of a material having high magnetic permeability; wherein the permanent magnet is ring-shaped and defines longitudinal axis that is parallel with the longitudinal axis of the center pole; wherein the longitudinal axis of the permanent magnet is coaxial with the longitudinal axis of the center pole; wherein the stator assembly defines a longitudinal axis that is parallel to the longitudinal axis of the center pole; where in the longitudinal axis of the stator assembly is coaxial with the

longitudinal axis of the center pole; wherein the permanent magnet is radially magnetized (See Fig. 5); wherein the magnet has one or more discontinuities such that the dominant eddy current path is interrupted; wherein the permanent magnet comprises a plurality of arc-shaped segments; wherein the armature assembly further comprises a valve stem (64) adapted to open or close a valve when current is applied to the coiled conductor; wherein the armature assembly further comprises: a means (See Figs. 1, 2a, 3, and 4) for coupling the valve stem to the remainder of the armature assembly; wherein the armature assembly further comprises one or more spacers (44) disposed between each of the permanent magnets; wherein the magnets and spacers are split in the axial direction; wherein the axial height of the magnet is greater than the axial height of the coiled conductor; wherein the center pole is formed of a paramagnetic material; wherein the center pole is at least partially formed of ferromagnetic material. Pp 6-7.

This ground of rejection is respectfully traversed. Claim 1 and the claims dependent thereon call for "a center pole formed of a material having high magnetic permeability." At least because the reference fails to disclose this claimed limitation, withdrawal of the rejection of claims 1, 2, 4-9, 11-19, 21, 25, 26, 31, 32 and 35 as anticipated by this reference is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote

verbatim the language in the reference he regards as corresponding to this limitation in the rejected claims.

7. Claims 48-52 stand rejected under 35 U.S.C. §102(b) as being anticipated by Hoppie.

The office action states:

Hoppie discloses an internal combustion engine (22) comprising: a cylinder (36) that defines a chamber; a valve (30) adapted to control the flow of a liquid or a gas into or out of the chamber; an electromagnetic actuator (28; 160; 200) coupled to the valve, the actuator comprising: a stator assembly (50) having an inner surface that defines an opening, the stator assembly comprising: a coiled conductor (52) disposed near the inner surface of the stator assembly, wherein the coiled conductor is adapted to generate a first magnetic field when current is applied; a center pole formed of a material (60) having high magnetic permeability and having a longitudinal axis; and an armature assembly (56) at least partially disposed within the stator assembly opening, the armature assembly comprising: a permanent magnet (58), wherein the armature assembly moves to open or close the valve when current is applied to the coiled conductor assembly; the said engine further comprising: a controller (24) configured to receive information about one or more operating states of the valve and apply a control signal to the coil to generate a magnetic field that causes the armature assembly to move relative to the longitudinal axis of the center pole, wherein the control signal is based on the information about one or more operating states of the valve (See Col. 4, line 65 through Col. 5, line 64); wherein the one or more operating states comprises valve velocity; wherein the one or more operating states comprise valve position; wherein the controller receives information about both the velocity and position of the valve and selectively applies a velocity feedback control and a position feedback control to position the valve. Pp. 7-8.

This ground of rejection is respectfully traversed. The reference does not disclose "a center pole formed of a material having high magnetic permeability" as called for by these claims. Accordingly, withdrawal of the rejection of these claims is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim at least the language in the reference regarded as corresponding to the limitation identified above.

8. Claims 1, 2, 4-9, 11-16, 19, 21, 32 and 35 stand rejected under 35 U.S.C. §102(b) as being anticipated by Kawamura. The office action states:

Kawamura discloses an electromagnetic actuator (See Figs1-2), comprising: a stator assembly (3) having an inner surface that defines an opening,

the stator assembly comprising: a coiled conductor (36-39) disposed near the inner surface of the stator assembly, wherein the coiled conductor is adapted to generate a first magnetic field when current is applied; a center pole (71) formed of a material having high magnetic permeability and having a longitudinal axis; and an armature assembly (22, 23) at least partially disposed within the stator assembly opening, the armature assembly comprising: a permanent magnet (2), wherein the armature assembly moves in a direction parallel to the longitudinal axis of the center pole when current is applied to the coiled conductor assembly; wherein the magnet is radially magnetized; wherein adjacent coils are configured to generate magnetic fields having opposite polarity; wherein the plurality of coils are connected in series; wherein adjacent coils are wound in opposite directions; wherein the stator assembly further comprises one or more back iron members formed of a material having high magnetic permeability; wherein the permanent magnet is ring-shaped and defines longitudinal axis that is parallel with the longitudinal axis of the center pole; wherein the longitudinal axis of the permanent magnet is coaxial with the longitudinal axis of the center pole; wherein the stator assembly defines a longitudinal axis that is parallel to the longitudinal axis of the center pole; where in the longitudinal axis of the stator assembly is coaxial with the longitudinal axis of the center pole; wherein the permanent magnet is radially magnetized (See Fig. 1-2); wherein the armature assembly further comprises a valve stem (See Fig. 1) adapted to open or close a valve when current is applied to the coiled conductor; wherein the armature assembly further comprises: a means (See Fig. 1) for coupling the valve stem to the remainder of the armature assembly; wherein the center pole is formed of a paramagnetic material; wherein the center pole is at least partially formed of ferromagnetic material. Pp. 8-9.

Claim 1 and the claims dependent thereon call for “a center pole formed of a material having high magnetic permeability and having a longitudinal axis” and the “armature assembly moves in a direction parallel to the longitudinal axis of the center pole.”

The reference discloses, “The upper electromagnet 7 comprises an upper magnetic pole 71 which confronts the upper shank end of the exhaust valve ...” Column 3, lines 26-27. The claimed center pole does not confront the upper shank end of the valve, but provides an inner path for aligning and guiding the valve stem and a magnetic return path for the magnetic circuit. The reference is thus functionally and structurally different from the invention of these rejected claims. Accordingly, withdrawal of the rejection of these claims as anticipated by the reference is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully

requested to quote verbatim the language in the reference he regards as corresponding to the limitations in the rejected claims quoted above.

9. Claims 48-52 stand rejected under 35 U.S.C. §102(b) as anticipated by Kawamura.

The office action states:

Kawamura discloses an internal combustion engine (6) comprising: a cylinder that defines a chamber; a valve (1) adapted to control the flow of a liquid or a gas into or out of the chamber; an electromagnetic actuator (See Fig. 1) coupled to the valve, the actuator comprising: a stator assembly (3) having an inner surface that defines an opening, the stator assembly comprising: a coiled conductor (36-39) disposed near the inner surface of the stator assembly, wherein the coiled conductor is adapted to generate a first magnetic field when current is applied; a center pole (71) formed of a material having high magnetic permeability and having a longitudinal axis; and an armature assembly (22, 23) at least partially disposed within the stator assembly opening, the armature assembly comprising: a permanent magnet (2), wherein the armature assembly moves to open or close the valve when current is applied to the coiled conductor assembly; the said engine further comprising: a controller (5) configured to receive information about one or more operating states of the valve and apply a control signal to the coil to generate a magnetic field that causes the armature assembly to move relative to the longitudinal axis of the center pole, wherein the control signal is based on the information about one or more operating states of the valve (See Col. 4, line 15 through Col. 6, line 2); wherein the one or more operating states comprises valve velocity; wherein the one or more operating states comprise valve position; wherein the controller receives information about both the velocity and position of the valve and selectively applies a velocity feedback control and a position feedback control to position the valve. P. 10

This ground of rejection is respectfully traversed. The reasoning set forth above in support of the patentability of claim 1 over the reference is submitted to support the patentability of claims 48-52, at least because the reference does not disclose the center pole formed of a material having high magnetic permeability. Accordingly, withdrawal of the rejection of claims 48-52 as anticipated by the reference is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim the language in the reference regarded as corresponding to the limitations in these rejected claims.

10,11. Claims 22-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hoppie as a primary reference in view of Mackal as a secondary reference. The office action states:

Hoppie discloses the invention, however, fails to disclose the said valve stem comprising a ball-shaped tip and being received by a ball joint of said armature assembly.

The patent to Mackal on the other hand, teaches that it is conventional in the valve art, to utilize a valve having a ball-shaped tip and being received by a ball joint assembly (16, 28)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the ball joint assembly as taught by Mackal in the Hoppie device, since the use thereof would provide an improved electromagnetic valve actuator which would make the valve stem to have side or rotational movement relative to the longitudinal axis of the center pole. P. 11.

This ground of rejection is respectfully traversed. "The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." *In re Gordon*, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984).

"Although the Commissioner suggests that [the structure in the primary prior art reference] could readily be modified to form the [claimed] structure, '[t]he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.'" *In re Laskowski*, 10 U.S.P.Q. 2d 1397, 1398 (Fed. Cir. 1989).

"The claimed invention must be considered as a whole, and the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick*, 221 U.S.P.Q. 481, 488 (Fed. Cir. 1984).

"Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under Section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so." *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984) (emphasis in original, footnotes omitted).

"The critical inquiry is whether 'there is something in the prior art as a whole *to suggest* the desirability, and thus the obviousness, of making the combination. [citing *Lindemann* with emphasis added.]" *Fromson v. Advance Offset Plate, Inc.*, 225 U.S.P.Q. 26, 31 (Fed. Cir. 1985).

These claims are dependent upon and include the limitation of claim 1 calling for a center pole formed of a material having high magnetic permeability. It is therefore impossible to combine the primary and secondary references to meet the limitations of these claims. "Moreover, we observe that even if these references were combined in the manner proposed by the examiner, that which is set forth in appellant's claims . . . would not result." *Ex parte Bogar*, slip op. p.7 (BPA&I Appeal No. 87-2462, October 27, 1989). "Even if we were to agree with the examiner that it would have been obvious to combine the reference teachings in the manner proposed, the resulting package still would not comprise zipper closure material that terminates short of the end of the one edge of the product containing area, as now claimed." *Ex parte Schwarz*, slip op. p.5 (BPA&I Appeal No. 92-2629 October 28, 1992). "Although we find nothing before us indicating why it would be desired to combine the references in the manner urged by the examiner, it is clear to us that such a modification by itself would not result in that which is set forth in the claims." *Ex Parte Kusko*, 215 U.S.P.Q. 972, 974 (BPA&I 1981). That it is impossible to combine the references to meet the limitations of these rejected claims is reason enough for withdrawing the rejection of them. Accordingly, withdrawal of the rejection of these claims as unpatentable over the primary and secondary references is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim the language in each reference regarded as corresponding to each limitation in each of these rejected claims, and quote verbatim the language in the references regarded as suggesting the desirability of combining what is there disclosed to meet the limitations of these claims.

12. Claims 33 and 34 stand rejected under 35 U.S.C. §103(a) as unpatentable over Hoppie (as applied to claim 1) as a primary reference in view of Modien as a secondary reference. The office action states:

Hoppie discloses the invention, however, fails to disclose the force of the armature as a function of displacement of the armature relative to the stator assembly is substantially constant over an intended range of excursion, and detent

force profile of the actuator as a function of displacement of the armature relative to the stator assembly is substantially zero over an intended excursion range of displacement.

The patent to Modien on the other hand, teaches that it is conventional in the electromagnetic actuator art, to utilize an armature (135) configured in an electromagnetic actuator (60) to achieve the force of the armature as a function of displacement of the armature relative to the stator assembly is substantially constant over an intended range of excursion, and detent force profile of the actuator as a function of displacement of the armature relative to the stator assembly is substantially zero over an intended excursion range of displacement (See Fig. 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the armature configuration as taught by Modien in the Hoppie device, since the use thereof would provide an improved electromagnetic actuator with less energy consumption in operation. P.12.

This ground of rejection is respectfully traversed. We have shown above that the primary reference does not disclose at least the center pole formed of a material having high magnetic permeability so that it is impossible to combine the primary and secondary references to meet the limitations of these rejected claims. That is reason enough for withdrawing the rejection of them. Accordingly, withdrawal of the rejection of claims 33 and 34 as unpatentable over the primary and secondary references is respectfully requested. Should this ground of rejection be repeated, the Examiner is respectfully requested to quote verbatim the language in the references regarded as corresponding to each limitation in these claims and quote verbatim the language in the references regarded as suggesting the desirability of combining what is there disclosed to meet the limitations of these rejected claims.

13. Claim 36 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Hoppie as a primary reference in view of Iida as a secondary reference. This ground of rejection is respectfully traversed.

We have shown above that the primary reference does not disclose the center pole formed of a material having high magnetic permeability called for by claim 36; therefore, it is impossible to combine the primary and secondary references to meet the limitations of claim 36. Accordingly, withdrawal of the rejection of claim 36 as unpatentable over the primary and

secondary references is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim the language in the references regarded as corresponding to each element in this claim and quote verbatim the language in the references regarded as suggesting the desirability of combining what is there disclosed to meet the limitations of this claim.

14. Claims 53 and 54 stand rejected under U.S.C. § 103(a) as being unpatentable over Hoppie as a primary reference as applied to claim 48 in view of Iida as a secondary reference. The office action states:

Hoppie discloses the invention, however, fails to disclose a cooling circuit being configured to cool the said actuator.

The patent to Iida on the other hand, teaches that it is conventional in the electromagnetic actuator art, to utilize a cooling circuit (38, 39; See Col. 4, line 57 through Col. 5, line 2) including a heat exchanger, a pump, and a cooling jacket (22, 38) to cool an electromagnetic actuator (23).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the cooling circuit as taught by Iida in the Hoppie device, since the use thereof would provide an engine with an improved electromagnetic valve actuator, without overheating during its operation. Pp. 13-14.

The primary reference does not disclose the center pole formed of a material having high magnetic permeability called for by these rejected claims. Accordingly, it is impossible to combine the primary and secondary references to meet the limitations of these claims. Accordingly, withdrawal of the rejection of these claims is respectfully requested. If this ground of rejection is repeated, the Examiner is respectfully requested to quote verbatim the language in the references regarded as corresponding to each limitation in these claims and quote verbatim the language in the references regarded as suggesting the desirability of combining what is there disclosed to meet the limitations of these claims.

15. Claims 53 and 54 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kawamura as a primary reference as applied to claim 48 in view of Iida as a secondary reference. The office action state:

Kawamura discloses the invention, however, fails to disclose a cooling circuit being configured to cool the said actuator.

The patent to Iida on the other hand, teaches that it is conventional in the electromagnetic actuator art, to utilize a cooling circuit (38, 39; See Col. 4, line 57 through Col. 5, line 2) including a heat exchanger, a pump, and a cooling jacket (22, 38) to cool an electromagnetic actuator (23)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the cooling circuit as taught by Iida in the Kawamura device, since the use thereof would provide an engine with an improved electromagnetic valve actuator, without overheating during its operation. P.14

This ground of rejection is respectfully traversed. We have shown above that the primary reference does not disclose a center pole formed of a material having high magnetic permeability called for by these claims. Accordingly, it is impossible to combine the primary and secondary references to meet the limitations of these claims. Accordingly, withdrawal of the rejection of claims 53 and 54 as unpatentable over the primary and secondary references is respectfully requested. If this ground of rejection is repeated the Examiner is respectfully requested to quote verbatim the language in each reference regarded as corresponding to each limitation in these rejected claims and quote verbatim the language in the reference regarded as suggesting the desirability of combining what is there disclosed to meet the limitations of these claims.

In view of the forgoing authorities and remarks, and the inability of the prior art, alone or in combination to anticipate, suggest or make obvious the subject matter as a whole of the invention disclosed and claimed in this application, all the claims are submitted to be in a condition for allowance and notice thereof is respectfully requested. Should the Examiner believe the application is not in a condition for allowance, he is respectfully requested to telephone the undersigned attorney at 617-521-7014 to discuss what additional steps he believes are necessary to place the application in a condition for allowance.


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Respectfully submitted,
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